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ABSTRACT

This paper describes first-year results of a project in Cleveland (Ohio) that was funded by the National Science Foundation. Cleveland's Problem Solving Infusion Program (PSIP) was designed to help teachers implement new mathematics standards and to empower them to make curricular decisions. In particular, the study examined whether urban teachers reformed mathematics instruction, and if so, how and how much. Data were derived from observation and interviews of 12 teachers (7 women, 5 men) during the first 6 months of 1989. The findings, which indicate that teachers worked for the letter of reform rather than its spirit, illustrate how school routines can be a major obstacle to educational change. Teachers' routines manifested themselves as school-keeping systems that ultimately maintained the status quo. Standard institutional programming, the teachers' limited concept of curriculum theory, and the tendency for teachers to follow established policy resulted in the continuation of business as usual. Comprehensive school improvement and curriculum reform requires: (1) teacher responsibility for providing effective problem-solving instruction; (2) public's trust in school teachers; (3) research of process-oriented teaching and learning; (4) the promotion of student learning as teachers' primary responsibility; and (5) a connection with the community's plans for urban reconstruction. (LMI)

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SCHOOL ROUTINES AND THE FAILURE OF CURRICULUM REFORM

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BIOGRAPHICAL SKETCH

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School Routines and the a Failure of Curriculum Reform

Abstract

This article describes a project in Cleveland funded by the National Science Foundation was intended to help teachers empower themselves as well as meet new math standards. The author examines whether urban teachers reformed mathematics instruction, and if so, how and how much. In this case, teachers worked for the letter of reform, not its spirit. The phrases curriculum reform and teacher empowerment remained just that: mere phrases. Teachers'rounines turned out to be school-keeping systemsthat turned out to maintain the dreary status quo. Standard institutional programming, the teachers' limited concept of curriculum theory, and the tendency for teachers simply to follow established policy meant that business as usual continued to dominate the curriculum.

INTRODUCTION

A prerequisite for success in many occupations today is the ability to solve mathematical problems. However, just when technology offers mathematical problem solving its greatest challenge and promise, the young people who could benefit most have serious academic deficiencies (Romberg 1988). Many of these children are poor, live in cities, and come from dysfunctional or historically disadvantaged minority or ethnic groups (National Center for Education Statistics 1991). These children's school records show high absenteeism, low academic achievement, and dropout rates near 50 percent, sometimes even higher. Their hopes not only for employment but for a good life in general are vanishing (Bruckerhoff 1988).

Recognizing this crisis, the National Science Foundation awarded the Cleveland Education Fund a two-year grant of approximately $200,000 in 1988 so that Cleveland's intermediate level mathematics teachers could reform their curriculum consistent with new standards from the National Council of Teachers of Mathematics (NCTM)and improve the urban children's performance in mathematics. Through meetings, lectures, workshops, and demonstrations, the

mathematics teachers were to reorganize the math curriculum, emphasizing problem solving. Project participants were to evaluate the effectiveness of problems through pilot tests and revise curriculum accordingly. The project's key innovation tied teacher empowerment to curriculum reform. However, first-year results showed the teachers' mathematics problem-solving curriculum and instruction remained standard fare. What happened?

The teachers practiced solving the curriculum writer's word problems,tested the problems with their students, and then reported the results to the curriculum writer. Through practice sessions and experimentation, the teachers would know how to solve the problems and what problem structure best suited their students. Later, this initial cadre of teachers would train other teachers, then this second group would teach a larger third, and so on until every Cleveland intermediate level mathematics teacher knew these methods and materials.

The present report describes Cleveland's problem-solving project from the project participant's viewpoint. The problem-solving project operated on a model of standard, goal-directed curriculum development. During the first year, the curriculum writer and core of intermediate-level teachers established a curriculum planning organization. The group met regularly, cooperatively solved math problems, and assigned problem-solving lessons to their students.

But no matter how carefully prepared the planning sessions were, teachers complained about teaching in this new way and expressed skepticism about the project's effectiveness. During interviews, teachers recalled short-lived initiatives and claimed that they had to overcome various obstacles, such as the envy of colleagues and too little support from school administrators. In truth, the curriculum writer lacked training in curriculum theory and was not a district employee. Also, the fact that the math curriculum supervisor had little involvement in the project showed how far outside administrative and ordinary curriculum development channels it was. Local and national funding agencies gave teachers considerable latitude, overestimating the teachers' leadership and self-discipline.

The attempt to reform intermediate level mathematics curriculum and empower Cleveland teachers failed. Halfway through its funding cycle, the project the project was off the tracks's. What might have been a real curriculum innovation was an absurd academic exercise; just more,

typical school work (see Bruckerhoff 1991; Ravitch 1983; Waller 1936, Wehlage and Rutter 1987), merely substituting one technical feature (problem solving) for another (traditional math) without consideration of the specific needs of the urban students. Cleveland's problem-solving initiative did not result in empowerment of teachers or substantive improvement of curriculum and instruction.

At year's end, despite reform language, district sanction, and sufficient financial support, math teachers' curriculum development and decision making had scarcely changed. Due partly to neglect of duties and partly to misguided preference for routines or standard procedures, Cleveland's mathematics curriculum maintained a mishmash of competing and fragmentary notions.xt, and curriculum issues.

The math teachers knew about the city kids who were abandoned and sometimes out of control, even belligerent,, but the teachers were unable or unwilling to bring children and curriculum into an intimate, mutually beneficial relationship. They resisted the project's curriculum decision-making role and continued the style of teaching. Some teachers' destructive attitudes toward their work promoted waste, sloth, and frustration. District policy that specified direct instruction was the standard interpretive framework, not process-oriented curriculum theory. Teachers' practice emphasized explicit teaching and dependence on the standardized course of study.

The project's shortcomings resulted from institutional policy, bad social conditions, and the teachers' resistance. This math curriculum innovation was small, narrowly focused, and short-term, but its results should make it clear to reform-minded policy makers and educators that real change is not the substitution of one isolated technique for another. Making a substantive educational difference requires a change in principle (Bruckerhoff 1988). If educators truly desire to improve urban children's problem solving and math achievement, the whole purpose of schooling, and not just the techniques, must change. And pedagogy nodw oriented on subjects must be reconceived to make students the heart of the matter.

The grant's two purposes—to implement the new standards for school mathematics and empower teachers to make curriculum decisions place this project in the "second wave" of school reform (Judge 1988). The first wave emphasized improving students' performance through routine

achievement testing, closer attention to basics, and increased graduation standards. The second wave has emphasized teachers' professional development.

While the first reform wave concentrated on students and curriculum and the second wave upon teacher training, neither tied curriculum development to urban community renewal. Current educational policy, legislation, and institutional practices widen the gulf between the children's everyday experience and what they are supposed to learn in school (Gordon and Bhattacharyya 1992). To offer a problem-solving curriculum as a solution to the urban child's low math achievement while neglecting urban community renewal is to overlook what damage poverty can do and the sensitive relationship between the child and the curriculum.

METHOD

This article reports first-year results of Cleveland's Problem Solving Infusion Project (PSIP). The researcher used field study methods, chiefly recording descriptive and historical data from his own observations and interviews with the project's director and curriculum writer, as well as with teachers, students, and the school district's regular supervisor of mathematics. The field work was conducted during six months from January through July 1989 and emphasized the natural history approach (Bruckerhoff 1991; Smith 1986). The researcher attended weekly faculty meetings; observed seven teachers' classrooms twice weekly for two periods each visit (N = 12; 7 women, 5 men with 15–25 years experience; 2 retired and 3 discontinued involvement); and interviewed teachers, the curriculum writer, university faculty, building principals, and the mathematics curriculum supervisor. The field study's basic purpose was to record (1) the mathematics teachers collaborative behavior and (2) the problem-solving curriculum and instruction.

The discussion begins by presenting the teachers' views of the PSIP. Teachers acknowledged the importance of a problem-solving curriculum for urban children, but they used PSIP materials only occasionally along with the regular, standardized course of study materials. Teachers' resistance to implementing the new math curriculum stemmed from their belief that students' low math achievement and poverty-stricken social environment, along with the district's competency-based education policy, discouraged creative and innovative teaching.

The second part of the discussion is a description of the problem-solving committee at work. Teachers practiced work sheets as the program prescribed, but they also waisted much time in talking shop and general grousing. The latter two, while very apparent, contributed little or nothing to the project. The math curriculum reform project gave teachers respite from regular work, time to review and practice, and extra pay.

The final section of the discussion presents the curriculum writer's explanation of the difficulties as well as some remarks by the district's mathematics curriculum supervisor. The writer lacked recent urban experience and theoretical background, while the supervisor did not participate in the project at all. Because these two key officials chose not to cooperate with each other, the project was insulated from the school system's ordinary curriculum development channels. Cleveland's intermediate level curriculum reform had nothing to do with the way it normally set curriculum.

THE TEACHERS' VIEW

The teachers, who all volunteered for the Problem Solving Infusion Project, usually spoke in terms that paralleled the project's language. For example, the project emphasized measurement and design of solid objects. When asked to comment about the math lab's manipulative collection, a teacher said,

> The math curriculum has to have an experience base because these kids don't have the same opportunities as advantaged kids. The math curriculum needs to become more physical. So, that's why I have them doing tessellations today.

Perhaps as often as once per week—usually the day after the curriculum workshop meeting—teachers guided their students through a class in which students either solved problems or manipulate something like geoboards. Teachers said that they were reluctant to include PSIP activities more frequently because the problem-solving curriculum they were developing had no apparent relation to the district's regular course of study. According to this same teacher,

> The activities of the problem-solving project are so varied that the kids don't know where they come from, and they coincide only now and then with the regular curriculum. For example, we might do some problems that have something to do with perimeter and find out later in the year where the project might fit in.

Because no one had used these materials previously, teachers and students were unclear about the PSIP subject matter in relation to the regular mathematics curriculum. This perceived mismatch led teachers to use the PSIP materials cautiously for bell work assignments or as demonstration lessons mostly for the researcher's benefit. Why?

Compliance with a court-ordered desegregation ruling meant that the district had to administer an annual, competency-based, standardized test to monitor students' achievement of grade-specific math objectives. Explicit teaching to the study objectives was minimum school instructional policy. All Cleveland teachers were well aware that creative or innovative teaching as in the PSIP project brought with it a risk that students would do badly on competency-based tests and that teachers would thus be transferred, supervised closely, or even fired. Some teachers, facing real or imagined threats from their principals, therefore made the minimum, explicit teaching their standard. One teacher summed up colleagues' resistance to change:

> If a teacher has the class under control, gets good grades from the students, and so on, then the job is being done. Teachers are not required to be creative and innovative. Most teachers just want to do the routine, because that is what the system requires (competency-based course of study).

Teachers said that typical student behavior and the school's workday organization (forty-minute class periods and three minutes for student rotation and class change)discouraged or even prevented using PSIP instruction and the building facilities flexibly. One teacher had this to say about using the school's math lab, which at her school was not located on the same floor as the regular math classrooms:

> I'd like to use our building's math lab more often, but I've tried it and it's just about impossible. You need time to do a worthwhile project. It would take me most of the period just to get the kids to the right room (lab) and settled down. The lab materials are great, and a break away from the regular classroom is good for all of us, but when I make time for manipulatives, I use the stuff down here [on this floor].

The math lab's appeal notwithstanding, teachers knew that they could count on the regular classroom, complete with thirty student desks in six rows and five columns, to help maintain order

and "cover" the objectives of the official course of study. On most school days, the math lab remained locked and empty.

All teachers agreed that local principals set tight limits on the curriculum decisions teachers could make. One teacher explained why some PSIP teachers seemed to lack of confidence in mathematics—and to be fearful and angry about empowerment issues:

> The administration is beating up on teachers for failing kids. Some principals demean teachers who consistently hold high standards and threaten these same teachers with lower evaluations. So, we keep two records: one we use for teaching and one we turn in to keep our jobs.

The expression *beating up on teachers* is a reference to harassment that may include placing teachers on intensive supervision, threatening nonrenewal or transfer to an undesirable location, and ridiculing and shouting at or even physically attacking teachers—sometimes even in the presence of students and colleagues. Since most of these teachers were women and most principals were men (or women following the system's ways), any inappropriate superordinate behavior was also sex abuse and discrimination. Partly because they were aware of this state of affairs, veteran teachers expressed no surprise at a colleague's preference not to question authorities or experiment with new materials and practices.

In the best of circumstances, one might expect that fresh, well-prepared recruits would replace retirees and burned-out or incompetent colleagues, who quit or get fired. But bad staffing practices contributed to the teachers' malaise. As one teacher put it:

> We have staffing problems that just shouldn't be going on. A teacher will take a sick leave and a substitute will be brought in on a long-term appointment. It might be OK if the substitutes knew math, but in most instances, they are certified in English or history. They start out the term with our students, and before long the damage has been done, because these people don't know math.
>
> The principal's hands are tied to people who work in the building. When someone retires or quits, the building gets to interview a new person. However, all of the interviewees are sent here from downtown. Recently, they had to hire three new people. There were only three people sent out for the interviews. No choice

was possible.

> Moving in people who are good from another building is possible, but that has its problems, too. We would have to get rid of other people and we just can't get rid of somebody except for just cause [i.e., incompetence or moral turpitude].

Despite the PSIP proposal's intention to spread reform through the district's intermediate level math curriculum, the PSIP teachers had a depressing outlook on themselves, colleagues, administrators, and the school system. For the foreseeable future, only accidental staffing changes would bring in new, reform-minded math teachers. Apparently, the PSIP teachers' only hope lay in principal endorsements or noninterference and their math colleagues' interests in professional development.

The meetings were to prepare materials and strengthen the authority of teachers, who traditionally have had little say in matters of curriculum. A teacher spoke as follows about the PSIP's weekly writing workshops:

> At these meetings with the curriculum writer, we talk about the problems he's developed, work them out ourselves, take them back to the classroom to try them out with kids, and tell him what did and did not work. Then, he revises them.
>
> Once we have been through it we will in-service the other teachers in these specific problems. Right now, it's like a testing period. We are taking all of the bugs out of it. The idea is to develop a workbook categorized according to the curricular area.

This description closely parallels the project's goals and objectives. However, this teacher and others also doubted whether the project really promoted mathematical problem solving and teacher empowerment. The same teacher continued:

> But is this problem solving? Or are we just getting together to work out some neat problems? We play around with them and have our students play around with them. Some of us use them, and some of us don't. I happen to know at least one person who does nothing with these materials. Is this empowerment? Are we really doing curriculum work?

Next, this teacher expressed what seemed to be a deep-seated concern:

> Our behavior at the meetings is so typical of teachers. I find myself getting caught up in the gossip and shoptalk. Some of the teachers are coming for the money, and that has little or nothing to do with math. We get paid for attending every meeting. Extra money is the reason some teachers come.

The PSIP intended to support teachers' collaborative curriculum development work. To the extent that teachers successfully carried out this work, urban students would learn mathematical problem solving and teachers would empower themselves. However, these teachers did only the work required of them and doubted that the goals would be reached. Their comments also reveal destructive attitudes toward their work and the program.

To make clearer what PSIP was like in its first year, the next section describes the problem-solving committee at work.

THE PROBLEM-SOLVING COMMITTEE AT WORK

In the 1989 spring semester, the curriculum writer, twelve teachers, and the researcher met at the Math Resource Center for about two hours two or three times per month. During these meetings the teachers practiced doing work sheets, talked shop, and groused instead of writing and revising the PSIP curriculum. While the practice sessions pertained to the project,shoptalk and grousing did not.

Frequently, not all twelve teachers attended the meetings they had either a school district meeting, or a crisis in their own schools, or some personal emergency. The curriculum writer devoted the first several meeting minutes to introductions, relevant news, and small talk. Within a short time, he adopted a businesslike demeanor, getting teachers seated at the table and ready to do work sheet practice.

Next, the curriculum writer distributed problem-solving exercise handouts he had prepared beforehand. He read the instructions and asked the teachers to complete the assignment. These instructions to the teachers were accompanied by a student work sheet packet, making up one problem-solving unit. As soon as possible after each curriculum planning session, teachers were to use the materials as a pilot exercise with their students. Ultimately they were to report the results to the committee. As they worked, the curriculum writer encouraged the teachers to talk about

the exercise; their impression of it and their opinions about how their students might react to it. Generally, the teachers followed these instructions. From time to time they diverged from their task to bring up problems they had had with a previous work sheet, discuss their students' misbehavior, complain about work, or talk about the news.

The teachers completed the exercises during three consecutive meetings, proceeding somewhat slowly, one sheet at a time. The curriculum writer controlled the pace so as to allow ample time for examining the pedagogical implications. He worked on the problems along with the teachers and talked about what he was doing, sometimes taking the student's role and sometimes the teacher's. It was typical for the teachers to ask a mere technical question, such as "Should students use colored pens?" It was uncommon for the teachers to theorize about problem solving, or discuss the implications of the exercise for teaching mathematics (perhaps as a science of pattern or order), or explore related teaching strategies (see Devaney and Sykes 1988).

With the committee's help, the curriculum writer assembled at the end of the first year a more or less polished collection of intermediate-level exercises in problem solving. Many of the teachers had participated in the problem-solving sessions, tested the exercises with students, and reported results. There was some discussion whether it would be better to have work sheets kept loose or bound; the workbook had more appeal because with it, the teachers would not have to copy materials. There was very little substance to discussions.

When teachers were not involved immediately in math problem solving, they sometimes talked shop. The topics were wide-ranging but common to teachers. Sometimes the topic was a spin-off from the exercise. At other times it had only a remote connection to the exercise but a more direct relationship to a teacher's urban classroom competence. Practical knowledge and technical skill were the teachers' most frequent topics.

As an example of a spin-off, one teacher described how her class responded enthusiastically to a problem-solving activity, but it disturbed teachers in adjoining classrooms. The other teachers acknowledged that they had had a similar reaction in self-contained classrooms. Since not all of the teachers were present to talk about this, they agreed to ask those who were absent to report on the same unit at the next meeting. The teachers then discussed classroom management techniques and student discipline. In the end, they vented their frustration at not

catching disruptive students and resolved to catch and expel them. Another popular topic was how to deal with students, colleagues, and administrators.

A more frequent shoptalk topic was instructional material choosing, producing, and using it. At some point in the meeting a teacher would declare that paper use was causing a problem. Who was paying for this? What do we do if we run out? What about the complaints from other teachers in the building? Should we run off 150 copies at a time or just enough for one class at a time? A teacher would raise similar questions about thermofax masters and transparency sheets. What kind should we be using? How can we make sure that there are enough to go around? Should each school get a box of masters or should we keep them at a central location? Someone present would give a practical answer to each of these questions. For instance, at one point there was a discussion about the quality of writing on thermofax masters. As a solution, one of the teachers had with him what he believed was the best mechanical pencil. This pencil was passed around for all of the teachers to examine.

There were long discussions about using equipment such as the thermofax machine, overhead projector, screens, and ditto machines. Sometimes one teacher would infer that another did not know how to use a machine correctly, which would cause unclear copies. This led another committee member to give detailed instructions how to run the machine correctly, what materials to use or avoid, and what to do if the machine broke down. The teachers seemed compelled to give out detailed machine operating instructions, tips, and shortcuts.

Some of the teachers' talk may have had a relationship to the project's goals and thus had a positive and professional aspect. However, some of the teachers rambled in complaining about the students and the misperceptions that administrators and other teachers had about the problem-solving project and its participants. In brief, the teachers were grousing. This behavior seemed to stem from a personal interest, a feeling that "I want to get this off my chest," and was often expressed in cynical terms.

When carrying on about students, the teachers' complaints concerned the "weird results" they turned in, the students' low morale, and their boisterous or violent behavior. It was typical for a gripe session to begin when one teacher would tell what had happened that day at school. Then, other teachers would relate additional stories, pointing out how these were similar,

sometimes providing more shocking examples.

In one instance a teacher talked about using handouts instead of transparencies, saying, "All that these students really want are material possessions, like the handouts, and they want them immediately." A second teacher acknowledged that this seemed to be true, but added that it was at least a good basis for using different media. To this the first teacher said, "We work so hard and try everything and yet the same kids who come in and refuse to do a damn thing. We all have them. I feel like, Jesus, am I accomplishing anything?" At this point all of the teachers began talking, and the meeting lost its focus. The curriculum writer called for a ten-minute break, which seemed to diffuse the emotional response and refocus the teachers' attention.

The teachers tended to treat the project as a matter of one isolated technique rather than an opportunity to examine the theoretical and practical aspects of their mathematics instruction in general (Hardy 1967; Polya 1991). By doing so, they kept themselves at the surface of the problems rather than delving to a more meaningful and productive level of reflection, analysis, and critique. This observer gets the impression that teachers' work consisted entirely of monotonous routines for tending machines, passing out work sheets, and monitoring students' behavior. There was little said about the pedagogy of mathematical problem solving or critical analysis and reflection, which leads to the issues of empowerment and judgment about curriculum. Colleagues rarely worked together outside of the project.

Although—according to the project—teachers were to assume curriculum decision-making responsibility, they tended to focus on technique and protecting their petty interests. The teachers missed an important opportunity to strengthen their power to make decisions. Considering the project's goals, these behaviors lowered expectations and led to unsatisfactory results. The researcher saw the project's dismal results as stemming from the teachers' passivity.

In addition to the other obstacles the project had to overcome, the teachers lacked knowledge and skill with higher-level organizational work. Some teachers knew that their discussions about materials and machines had little to do with problem solving, and they recognized the gossipy lounge talk for what it was. Apparently, peer pressure, work day weariness, and their need for relief kept teachers from objecting at meetings. As the quotes in the previous section indicate, the teachers did speak privately to the researcher about the committee's

results and their classroom practice.

Teachers seemed unconcerned about empowerment. Indeed, teachers never mentioned curriculum decision making. As the next section shows, the curriculum writer prepared problem-solving materials and guided teachers' practice sessions, but math curriculum reform and teacher empowerment eluded him.

THE CURRICULUM WRITER

The PSIP curriculum writer was a high school mathematics teacher at a suburban school district. He had twenty-three years of experience in mathematics teaching and curriculum development, but mostly in suburban and small-town schools. He had a good reputation for developing math curriculum, but his usual work environment, his only superficial acquaintance with urban school children, and his decision to work things out himself contributed to the gap between the urban child and the new math curriculum.

The curriculum writer began his account by saying that the project had gotten off to a late start in November because this was "a huge district where inertia is a natural part of it". The twelve teachers volunteered and, according to the curriculum writer, "were very enthusiastic about getting together to look at new materials and use them." However, he indicated that there was some confusion about roles and relationships. The grant required teachers to "take a bigger share than they did in shaping the math problem-solving curriculum. *They* should develop problem-solving activities correlated to course objectives." The teachers resisted and made it clear that they expected the curriculum writer to prepare all the materials.

By February the curriculum writer had resolved the confusion. He said, "I simply concluded that nothing would be done by the group unless I worked everything out beforehand." According to the curriculum writer, the teachers' new role was "to work hard between meetings to make sure this stuff works." By mutual consent, they adopted a typical manager-directs-and-worker-follows framework. Despite the project's claims about teachers as curriculum developers, these teachers' curriculum reform would entail review and practice lessons. There were other compromises. In the statement to follow, the curriculum writer describes and criticizes the writing project.

The material we made concerns visual thinking and processing of information from visual to verbal and back again. There is a certain amount of problem solving, in that we give the kids a problem and see how they deal with it.

I'm not operating out of any really conscious theoretical construct. A good problem solver may draw a picture, make a model or chart, list the steps, reread the problem.

Each curriculum unit is a theme with a topic. It starts out fairly tame and then these wrinkles appear. These wrinkles are the problems for the kids. The problems at the end of the week are a real challenge.

The teachers report back to me in the committee whether the kids like it, whether they can complete it successfully, and whether they think the kids are learning something. A convincing factor is whether the kids take it home at night and bring it back the next day.

However, the feedback I get from the teachers isn't satisfactory. For one thing, I can't tell whether there is any growth among the kids. I'm hoping that we can do some testing. Also, we need to meet more often so that the teachers do more and more of this material.

For another thing, teachers and administrators are at cross-purposes. According to some administrators, we can do anything we want, because nothing that the system does works. However, when you propose something new to the teachers, they will say that you have to ask the principals. Why? Because some principals would not agree to teachers' using this material. Too many principals have traditional ideas about teaching and testing. They monitor their teachers, change grades, and penalize teachers who fail students.

The teachers have so little authority. They will say, "I don't dare flunk kids."

I have some other serious concerns. The teachers like doing these practice problems. The kids like it. But I feel guilty about not having made a huge stack of curriculum materials. Right now our work is a bit free, and I am a little worried

about what happens when we move it from these twelve teachers out to the whole district.

I'd feel better if a psychologist said, "This is exactly what these kids need." Or, if some math expert said, "This is just the math they need." I don't have anybody who oversees the mathematical worth of what we are doing. We need somebody in the back of these classrooms watching this. I think these materials should be going to some kind of review board.

Things are not going well with the curriculum planning. For instance, I passed this material out at the meeting last week. We did page one and then I passed out page two. The teachers said, "We should make page two before page one." Then, I gave them page three, and they wanted it before page one. When I passed out pages four and five, they did the same thing with these pages. They said these last two should go before all of the others. I thought the material at the end was the hardest. So, I was to go home and rewrite the pages, but not put the page numbers on them.

I'd like to bring in something that they think is really good and then they talk about the various ways in which they can do this, rather than my bringing something in and they all say, "Oh, we gotta fix this."

The teachers and the students worked out the mathematical problems, but the material did not meet the project's goals. The curriculum writer lacked urban teaching experience and made too many concessions. Acknowledging the teachers' preference not to design their own problem-solving materials, the curriculum writer compiled the materials himself and directed teachers' review and practice sessions. Instead of teachers assuming curriculum decision-making responsibility, a school psychologist and math expert would validate the problem-solving materials. The curriculum writer was uncomfortable with the risk or uncertainty associated with problem-solving curriculum development. He concluded that there should be more rigorous curriculum design and an external board of specialists to review their results.

The late start, teachers' voluntary participation in the curriculum committee, and sloppy organization also contributed to poor results. During curriculum development meetings, people

were confused about work roles, disagreed about results, and had no theoretical framework. The teachers preferred an externally controlled curriculum, including preestablished problems and explicit procedures. Also, the teachers and the math curriculum director wanted to publish a workbook, but the curriculum writer had misgivings about this idea because such books already existed.

The curriculum writer's perspective raises a number of questions, three of which are worthy of consideration. What is the nature of problem solving as part of math instruction? How should teachers contribute to curriculum development? How should these problems be evaluated? The curriculum writer's comments suggest that the project neglected the *principles* of mathematics and curriculum (see Romberg and Carpenter 1986). Lacking a theoretical orientation himself, he sensed a need for confirmation from external agencies or experts and generally avoided the teachers as much as the district's course of study. The curriculum writer simply cobbled together a problem-solving kit.

The teachers remained passive in problem solving and curriculum planning, shunning responsibility (see Erickson 1986 and Maeroff 1988). The curriculum writer's decision to "work things out beforehand" guaranteed that problem solving would be artificial for teachers. The teachers' compliance gave assurance that the students' problem solving would also be artificial. The curriculum writer's dilemma whether to publish a problem-solving workbook foreshadowed the projects' limited effect. His indecision was a major problem.

The curriculum writer rarely (if ever) referred to the district's mathematics curriculum director, who was chiefly responsible for mathematics curriculum development in compliance with state guidelines. Contrary to the project's intent and to sound curriculum development policy, they chose not to collaborate. The state of Ohio had passed legislation recently that required all districts to follow a course of study. Also, Cleveland public school policy stipulated that all teachers plan according to Pupil Performance Objectives (PPOs). A teacher's PPO was a detailed listing of content specific objectives for competency-based instruction. In theory at least, teachers, curriculum committees, and content area supervisors were to derive PPOs from specific knowledge bases and the district's course of study; in practice, the PPO list was made up from currently used textbooks and standardized achievement tests. From the mathematics curriculum

director's viewpoint, the problem-solving project failed because it was not integrated with the course of study. He had this to say:

> There are some things coming out of the problem-solving project that are good, but it has some critical issues to deal with. Before they begin next year, they should have some kind of chart or plan that shows what should be produced and when. Let's imagine for a moment that the new school year is about to start. A math teacher has to know something about how to start out the year with problem solving.
>
> So, the project is kind of a hit-and-miss affair, in my opinion. It would be nice if they had enough activities, so that these could be coordinated with all of the chapters in the textbook. That way, they could always be working with a concrete model. The bottom line is this: they have to give kids problems to solve. They've got to get the kids involved.
>
> Where are we with the first year of work in? I think they should have produced more by this time. The teacher empowerment thing is ticking off some of the other math teachers in the district, who are not on the committee. What if they get angry and decide not to use these materials once they are developed? Also, the committee consists of some people who are just there for the fifty bucks. They are willing to do whatever they are told, so long as they get paid. What are they going to do about all of that?

The director was skeptical and referred only only in veiled terms to the PSIP curriculum writer. The director wanted an explicit problem-solving curriculum integrated with the district's course of study. From his perspective, curriculum planning for problem solving is a policy of "steady as she goes"(see Smith 1986). As things stood, he said, the project lacked direction and left too much to chance. The project's general disorganization led to poor results and may have encouraged teachers' unprofessional conduct. Mathematical problem solving should be a preplanned classroom activity and not an open-ended, process-oriented teaching lesson. The curriculum director, like his central office supervisors, wanted teachers to follow the district's course of

study. The curriculum writer and math curriculum director were far apart, and their noncollaboration ensured that they would remain so.

DISCUSSION

This account of the Cleveland teachers' Problem Solving Infusion Project shows how school routines can be a major obstacle to curriculum reform. According to the proposal, teachers would receive support for collaborative work and for assuming more responsibility in decision making. Cleveland's intermediate-level children would receive higher quality, up-to-date problem-solving instruction that would improve their performance in mathematics. However unprofessional conduct and bad school policy threw the project out of focus. In particular, teachers acted at the workshop in ways thwarting the project's goals. The curriculum development plan and problem-solving decision making fell victim to well-worn routines maintained by- external authorities, the curriculum writer and the district's course of study. And the teachers chose to evade their political, professional, and pedagogical responsibilities.

The curriculum writer's explanation of the problems was that there was too little guidance. He believed that if he could consult with a board of experts, they would relieve his anxiety about choosing the right mathematics problems, the correct sequence of problems, and appropriate solutions to the math problems. The curriculum writer thought that the difficulties he and the teachers were having could be resolved once they produced the workbook of word problems in conformity with Cleveland's pupil performance objectives. However, he acknowledged that the workbook could possibly interfere with the new problem-solving curriculum for the same reasons as previously published materials stifling thought and discouraging creativity. His avoidance of the curriculum director, course of study, and pupil performance objectives suggested that he expected the old system to absorb their new approach. His musings at the end of his interview indicated that he thought there were serious discrepancies between their direction and the intent of the new standards. He was searching for sources of difficulty among students, teachers, schools, and their revised mathematics curriculum.

Interviews with PSIP teachers showed that they believed problem-solving activities were important additions to the urban children's math curriculum. The teachers would say that the explicit, textbook approach that they had used before the project was unsatisfactory. They

believed that the project's techniques could improve urban children's math achievement, particularly when problem-solving lessons included manipulatives, such as geoboards, containers, figures, rulers, and so on. However, these teachers also said that the requirements of the course of study, the children's low math achievement and nonsupportive home life forced teachers back to standardized pupil performance objectives. From the teachers' viewpoint, these new math problems would be mere frills or distractions unless they could become part of an official curriculum plan. The math teachers chose to stick with the district course of study although they were fully aware that a much greater effort was required for urban children to achieve real success in a standard math curriculum. The PSIP teachers temporarily adapted the new routines to their jobs, but none believed that this project would succeed—and it did not. It seemed inevitable that their "reform" of problem solving would be co-opted by the very thing they were trying to replace—the routinized status quo.

This project was stymied by the institution's competency-based, standardized course of study. Indeed, the system's routines must smother any experimental curriculum planning. Clarifying the practice-experiment distinction is very important for promoting curriculum change. However, traditional school organizations confuse practice with experiment, depend on established routines, and frustrate creative techniques. A curriculum reform project devoted to practice, as Cleveland's did, would be a study in contradiction.

John Dewey (1936, 464) noted that the intention of his Chicago Experiment was *not* to develop a "practice school." His position on experimental curriculum planning is instructive. Dewey's main point is this: an experimental curriculum supports the continuous pursuit of understanding that is *both moral and intellectual* (1936, 465). He meant that, intellectually, curriculum planning includes the selection and study of subject matter with consideration for its best reorganization and presentation to particular students. In this way, experimentation is a constituent feature of the teacher's interactions with students. Experimentation is not a detached series of practice exercises, but rather an opportunity to see and evaluate the results. Concerning the moral aspect, today there is an epidemic of disadvantaged children. Their daily lives are smothered by poverty, hunger, hopelessness, violence, drug and alcohol abuse, AIDS, homelessness, and adolescent parenthood. The personal and social aspects of childhood in cities

like Cleveland make solving the problem of education an obvious and especially urgent moral imperative.

Continual emphasis on practice obscures the real value and function of reform and experiment in curriculum planning and postpones the day when children will enjoy the benefits of moral and intellectual education. Some of these teachers were deficient in math itself and some were mediocre. Furthermore, many lacked an understanding of what could make mathematical problem solving a vital interest to these children. An intensive effort should be undertaken to improve the teaching of mathematics.

When math teachers planned to use PSIP methods and materials, they perceived themselves and their students as possibly running afoul of the school's schedule and policy requirements. Systematic teaching and competency-based learning were the district's most highly regarded strategies for insuring compliance with Ohio's education policies and Cleveland's court-ordered desegregation. These policies and practices subtly discouraged teachers from functioning as autonomous professionals. Teachers would risk losing their jobs if they deviated from the course of study. Teachers' behavior at the project meetings—understandable but not acceptable—suggested that routinization had become commonplace, even definitive. With the first year of the project behind them, their decision making would involve no more than adjusting minor details while teaching word problems, which was not different from their previous role. Unacknowledged resistance to reform was an inherent feature of this traditional system.

The unsuccessful curriculum reform project in Cleveland has several implications for the future. In the first place, teachers have an obligation to provide effective problem-solving instruction to urban children and to assume rights and responsibilities appropriate to their occupation. Systems do not make moral and intellectual decisions; people do. Second, a school system like Cleveland's, its leaders and the citizenry have a moral responsibility to trust its public school teachers to be more responsive to children's needs. Public *trust* must be the central feature of curriculum reform; otherwise, the "second wave" of reform will be piecemeal and ineffective (Darling-Hammond 1988). Third, improvement of problem-solving instruction and urban children's mathematics achievement depends on a research of process-oriented teaching and learning (Romberg and Carpenter 1986). Fourth, comprehensive improvement of an urban

education program requires policy makers to promote students' learning as the teachers' primary responsibility; make individual schools into consistent, intensive, and flexible institutions for educating present-day children; and coordinate a network of local services for the social and physical welfare of children. Finally, any effort to improve America's urban public schools must be linked to the particular city's plans for urban reconstruction. With such general reforms, children now desperate would learn problem solving, and much more, will know that a formal education offers hope for tomorrow.

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